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(54) Dough stretching.

(57) An apparatus and a method for stretching a strip of dough (1) into a thin sheet. The apparatus comprises a roller mechanism (R) having a plurality of rollers (2) movable along an endless roller path (X), the peripheries of the moving rollers forming a closed envelope (Y) having a lower straight portion (S), and a belt conveyor mechanism including entrance (18) and exit (20) belt conveyors, these conveyors extending under the roller mechanism. The vertical spacing (Ta) between the upper flight (9) of the entrance belt conveyor and the said lower straight portion is variable to match the thickness (T<sub>1</sub>) of the strip of dough to be fed into the apparatus. The vertical spacing (Tc) between the upper flight (10) of the exit belt conveyor (20) and the said lower straight portion is also variable, at need, to set the thickness of the dough sheet to be produced.

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"Dough Stretching"

This invention relates to the stretching of dough, such as cake dough, bread dough, noodle dough or the like, and particularly to an apparatus and method for continuously stretching a strip  
5 of dough, supplied in the shape of a thick layer, into a thin sheet.

Apparatus for this purpose is well known from, for example the disclosures of U.S. Patent Specifications Nos. 4,056,346, 4,276,317, and 4,192,636.  
10 In these U.S. Patent Specifications there is disclosed an apparatus for continuously stretching a strip of dough, comprising:

a belt conveyor mechanism comprising a plurality of belt conveyors arranged in series, the upper  
15 flights of which are adapted to underlie and support the strip of dough to carry it along a predetermined path, said series of belt conveyors including an entrance belt conveyor for feeding the strip of dough into the apparatus, and an exit belt conveyor  
20 for discharging the stretched strip of dough from the apparatus, the exit belt conveyor being movable faster than the entrance belt conveyor; and

a roller mechanism comprising a plurality of freely rotatable rollers movable in unison along  
25 an endless roller path, the peripheries of the moving rollers forming a closed envelope having a lower straight portion spaced from and above the upper flights of said series of belt conveyors so that the rollers contact the strip of dough  
30 during their movement along said lower straight portion. the rollers being arranged to move in the same direction as the strip of dough when passing along said lower straight portion but at a speed greater than that of the said strip;

the upper flight of the said exit belt conveyor being located substantially parallel to said lower straight portion to define a predetermined vertical spacing therebetween; and

- 5 the upper flight of the entrance belt conveyor being located either parallel to, or in a tapering relationship with, said lower straight portion to define a predetermined vertical spacing between the starting point of said lower straight portion,  
10 or points adjacent thereto on the said envelope, and the upper flight of the entrance belt conveyor.

- In order to obtain a stretched dough sheet having a desired thickness, it is often required to control the vertical spacing between the upper  
15 flight of the exit belt conveyor and the lower straight portion of the said closed envelope. In known apparatus, the control of such spacing is carried out by vertical movement of the roller mechanism only. Such movement of the roller mechanism,  
20 however, naturally results in a change in the vertical spacing between the upper flight of the entrance belt conveyor and the above-mentioned lower straight portion. Consequently, if such spacing becomes too large, the strip of dough conveyed by the entrance  
25 belt conveyor tends to be wholly or partially out of contact with the rollers moving along their lower straight run, while if such space becomes too small the strip of dough tends to contact the rollers of the roller mechanism before they reach  
30 the lower straight run. Both of these circumstances will result in unsatisfactory dough stretching, and thus such a spacing control as this, relying only on vertical adjustment of the roller mechanism, is applicable only to cases where the thickness  
35 of the strip of dough supplied to the apparatus is within a limited range.

One solution to this difficulty, proposed by the present invention, is to make the upper

flight of the entrance belt conveyor pivotable  
up and down or movable vertically, so that the  
rollers moving along their lower straight run can  
be brought into proper contact with a strip of  
5 dough of whatever thickness conveyed by the entrance  
belt conveyor.

Such an improvement can meet the requirements  
of providing simultaneously not only a desired  
vertical spacing between the upper flight of the  
10 exit belt conveyor and the said lower straight  
portion of the roller envelope, by adjusting the  
roller mechanism in known fashion, but also a desired  
vertical spacing between the upper flight of the  
entrance belt conveyor and the said lower straight  
15 portion.

It will readily be understood that such requirements  
can also be met by changing the positions of the  
upper flights of both the entrance and exit belt  
conveyors, while the position of the roller mechanism  
20 is held unchanged.

If circumstances require, it is also possible  
to meet the said requirements by first vertically  
adjusting the roller mechanism to provide a desired  
spacing between the lower straight portion thereof  
25 and the upper flight of the entrance belt conveyor,  
without moving the latter, in dependence on the  
thickness of the strip of dough to be fed into  
the apparatus; and then by vertically adjusting  
the upper flight of the exit belt conveyor to conform  
30 the vertical spacing between the said lower straight  
portion and the upper flight of the exit belt conveyor  
to a desired thickness of the dough sheet to be  
discharged out of the apparatus.

Thus viewed from a first aspect the present  
35 invention provides an apparatus as already set  
forth above in connection with the prior art, charact-  
erized in that, of the roller mechanism and the  
said upper flights of the entrance and the exit

belt conveyors, at least two of such three parts are arranged to be positionally adjustable in the vertical direction so as to provide a desired vertical spacing between the starting point of the said lower straight portion, or points adjacent thereto on the said envelope, and the upper flight of the entrance belt conveyor, and/or a desired vertical spacing between the upper flight of the exit belt conveyor and the said lower straight portion, depending on the thickness of the strip of dough to be fed into the apparatus and the desired thickness of the sheet of dough to be discharged out of the apparatus.

In circumstances where there is no necessity for changing the thickness of the dough sheet to be discharged and only the thickness of the strip of dough fed into the apparatus is variable, the upper flight of the entrance belt conveyor can be the only member whose position is vertically adjustable.

Thus viewed from another aspect of the present invention provides an apparatus again as set forth above, characterized in that the said upper flight of the entrance belt conveyor is positionally adjustable so as to provide a desired vertical spacing between the starting point of the said lower straight portion, or points adjacent thereto on the said envelope, and the upper flight of said entrance belt conveyor, depending on the thickness of the strip of dough to be fed into the apparatus.

In a dough stretching apparatus of this kind, the strip of dough discharged out of the apparatus is usually formed so as to have substantially the same width as the strip of dough fed into the apparatus. It is possible, however, to produce a stretched sheethaving a width different from that of the unstretched strip.

Viewed from yet another aspect the present invention provides a method of continuously stretching dough, comprising:

5 (a) feeding a strip of dough onto the upper flight of an entrance belt conveyor constituting the first in a series of at least two belt conveyors;

10 (b) applying pulling forces to the strip of dough by moving each of said series of belt conveyors at a speed greater than the adjacent upstream belt conveyor, while the strip of dough is repeatedly contacted by a plurality of freely rotatable rollers moving along a lower straight portion of an endless roller path, which  
15 extends above said series of belt conveyors, and along which the rollers are moved in unison in the same direction as the strip of dough but at a speed greater than those of the belt conveyors; and

20 (c) discharging the stretched dough by means of an exit belt conveyor constituting the last in said series of belt conveyors, the upper flight of the exit belt conveyor being located substantially parallel to the said  
25 lower straight portion of a closed envelope which is formed by the peripheries of the rollers moving along the said endless roller path;

characterised by:

30 (d) setting a vertical spacing between the said upper flight of the exit belt conveyor and said lower straight portion of the endless roller path so as to obtain the desired thickness of the stretched dough sheet to be discharged,

35 taking the restoring force of the dough into consideration;

(e) setting the speed of the exit belt conveyor at a desired value;

- (f) measuring the thickness of the strip of dough to be fed into the system;
- (g) adjusting the vertical spacing between the said upper flight of the entrance belt conveyor and the starting point of the said lower straight portion, or points adjacent thereto on the said envelope, so as to conform to the thickness of the strip of dough to be fed in; and
- (h) controlling the speed of the entrance belt conveyor in proportion to the ratio of the desired thickness of the sheet of dough to be discharged to the thickness of the strip of dough to be fed in.

In circumstances where the resilience of the dough being stretched is substantially zero, the thickness of the dough sheet to be produced is practically equal to the vertical spacing between the upper flight of the exit belt conveyor and the lower straight portion of the roller envelope. However, if the dough is very resilient, the thickness of the dough sheet to be produced is slightly greater than such spacing.

Some embodiments of the invention will now be described by way of example and with reference to the accompanying drawings, in which:

Figure 1 is a schematic side view of a known apparatus, in which neither a roller mechanism nor the upper flights of the entrance and exits belt conveyors is arranged to be positionally adjustable;

Figures 2 and 3 are schematic side views of another known apparatus, in which only the roller mechanism is arranged to be adjustable;

Figure 4 is a schematic side view, partially broken away, of a first embodiment of an apparatus according to the present invention;



Figure 5 is a schematic side view, partially broken away, of a second embodiment of the invention; and

Figure 6 is a block diagram illustrating the operation of the apparatus.

Referring to the embodiment of Figure 4, an apparatus according to the present invention comprises a roller mechanism R and a belt conveyor mechanism. The roller mechanism R comprises a plurality of rollers 2, each freely rotatably mounted on a shaft 3. The shafts 3 are attached to a chain 4, which is trained under tension around a pair of sprockets 7 and 8 mounted on shafts 5 and 6 respectively. These sprockets in turn are mounted on a frame 24. The shafts 3, and thereby the rollers 2, are thus movable around an orbit X. During such movement of the rollers 2, the path of movement of the peripheries of the rollers defines a closed envelope as indicated by Y. The roller mechanism R is constructed so that the envelope Y has a lower straight portion S.

The belt conveyor mechanism is composed of two belt conveyors, namely an entrance belt conveyor 18 for feeding a strip of dough 1 into the apparatus, and an exit belt conveyor 20 for discharging the stretched sheet of dough from the apparatus. The upper flights 9 and 10 of the entrance and exit belt conveyors 18 and 20 underlie the roller mechanism R. Although the belt conveyor mechanism is illustrated as having two belt conveyors, it may be composed of any plural number of such conveyors. The upper flights of all of the belt conveyors are arranged in series, and the speed of each of the conveyors is faster than that of the next upstream conveyor, in operation.

The upper flight 9 of the entrance belt conveyor 18 is supported by a conveyor plate 15. The plate 15 is connected to an arm 14, the downstream end

12 of which is pivoted on the shaft of a roller of the exit belt conveyor 20, so that the inclination of the plate 15 can be changed relative to the lower straight portion S of the roller mechanism

5 R.

A cam 13 engages the underside of the plate 15 at its upstream end portion, the cam being mounted eccentrically on a shaft 11 which is rotatable about its axis by a motor 16 through gear means interconnecting these members. Thus, the upper flight 9 of the conveyor 18 can have its inclination changed by rotation of the eccentric cam 13, to increase or decrease the spacing Ta between the upper flight 9 and the lower straight portion S of the roller mechanism R. It should be noted throughout the description that the spacing Ta just mentioned corresponds to the distance between the top surface of the upper flight 9 and the starting point of the lower straight portion S, or points adjacent thereto, of the envelope y.

Although in the illustrated embodiment the upper flight 9 of the conveyor 18 is located in tapering relationship to the lower straight portion S of the roller mechanism R, and that the inclination of the said upper flight 9 is arranged to be changeable, the upper flight 9 may alternatively be arranged parallel to the lower straight portion S and be movable only in the vertical direction, without changing its angle relative to the portion S, for example by means of a device which will be described hereinafter with respect to the movement of the upper flight 10 of the exit belt conveyor 20 in Figure 5.

The entrance belt conveyor 18 is driven by a roller 19 which is in turn driven by a variable speed motor 17 whose speed is arranged to be variable in response to external signals, whilst the exit

belt conveyor 20 is driven by a drive roller 22 which is in turn driven by a motor 21.

Reference numeral 23 designates a sensor for measuring the thickness  $T_1$  and the width  $W_1$  of strip of dough 1 fed into the apparatus.

The roller mechanism R is supported by a pair of said frames 24 positioned at its respective opposite sides, and each frame 24 is integrally connected to a pair of vertical shifting devices D, at at its front and rear ends respectively, by way of brackets 25 which form part of the devices D. A post 26 extends vertically through the centre of each device D, and is in threaded engagement with the bracket 25. A casing 51 of the device D is secured to the bracket 25, and is in telescopic sliding engagement with a base part 52, which is securely connected to an outer frame 32 of the belt conveyor mechanism. The post 26 is rotatable about its axis by a motor 27.

In the known apparatus shown in Figures 2 and 3, a roller mechanism R is arranged to be moved vertically by devices similar to the devices D of Figure 4, but both the upper flight 9 of the entrance belt conveyor 18 and the upper flight 10 of the exit belt conveyor 20 are fixedly and immovably mounted. Therefore, when a desired thickness of dough sheet is to be produced, the roller mechanism R is moved vertically to set the spacing  $T_c$  between the upper flight of the exit belt conveyor 20 and the lower straight portion S of the roller mechanism R. Such vertical movement of the roller mechanism R also changes the spacing  $T_a$ , since the position of the upper flight 9 of the entrance belt conveyor 10 is held unchanged. It is a rare occurrence for the spacing  $T_a$ , as so set, to come close to the thickness  $T_1$  of the strip of dough fed into the apparatus, as will readily be seen from Figures 2 and 3, Figures 2 showing a case where the spacing

Ta is too large and Figure 3 a case where it is too small. These circumstances will not change even if the upper flight 9 of the entrance belt conveyor 18 is fixedly located in a tapering relationship with the lower straight portion S of the roller mechanism R.

The embodiments of Figure 4 overcomes these difficulties of the known apparatus exemplified in Figures 2 and 3. Thus the change in the spacing Ta, which is caused in the known apparatus by the vertical movement of the roller mechanism R, can readily be compensated for by pivoting the upper flight 9 of the entrance belt conveyor 18, so as to conform the spacing Ta to the thickness  $T_1$  of the strip of dough to be fed into the apparatus.

It will readily be understood that such adjustment of the spacing Ta can also be effect merely by moving the upper flight 9 vertically without pivoting it, although no means for carrying out such an operation is shown in the drawing. It will also be clear that such a procedure of pivoting (as well as vertically moving) the upper flight 9 can be applied to circumstances where the upper flight 9 is originally positioned parallel to the lower straight portion S of the roller mechanism R.

In another embodiment of the invention, shown in Figure 5, the upper flight 110 of an exit belt conveyor 120 is arranged to be movable vertically, in addition to the upper flight 109 of an entrance belt conveyor 118 being pivotable similarly to the device of Figure 4. The only difference in structure between the entrance belt conveyors of Figures 4 and 5 is that a conveyor plate supporting arm 114 in Figure 5 is pivoted on a shaft which is mounted on the outer frame 32 of the belt conveyor mechanism, whilst in Figure 4 the arm 14 is pivoted on the shaft of one of the rollers of the exit belt conveyor 20.

In the Figure 5 embodiment the setting of the spacing Tc is carried out by vertically adjusting the upper flight 110 of the exit belt conveyor 120, instead of vertically adjusting of the roller mechanism R as in the embodiment of Figure 4.

Thus the upper flight 110 is supported by a conveyor plate 128, the opposite ends of which are curved in order that the conveyor belt can run smoothly therearound. The ends are in fact formed by rollers 123 whose shafts are attached to the plate 128. The plate 128 is mounted on shafts 129 which are vertically movable by means of a motor 131 driving through gearing 130.

It will thus be understood that in apparatus according to the present invention, a desired spacing Ta and/or a desired spacing Tc can be set by vertically adjusting the roller mechanism R and one of the upper flights of the entrance and exit belt conveyors, or alternatively by moving the upper flights of both the entrance and exit belt conveyors.

Another feature of the present invention will be explained.

In another known apparatus, shown in Figure 1, neither the roller mechanism R nor the upper flight 9 and 10 of the entrance and exit belt conveyors, is provided with any means for moving them. In other words, neither the spacing Ta nor the spacing Tc is arranged to be adjustable.

In use of such known apparatus, if a strip of dough A fed into the apparatus is so thin that the dough strip on the upper flight 9 of the entrance belt conveyor 18 can contact the rollers 2 only over the length 1' as seen in Figure 1, the rolling distance over which the rollers 2 are effective is too short to sufficiently stretch the dough. In such a case, the strip of dough becomes uneven in thickness, and it may consequently be torn apart at the space between the upper flights 9 and 10

of the entrance and exit belt conveyors 18 and 20, or it may stick to the upper flight 10.

If on the other hand a strip of dough B fed into the apparatus is so thick that the dough strip on the upper flight 9 comes into contact with the rollers 2 before they begin their lower straight run, thereby resulting in an unnecessarily long contact length  $l$  as also seen in Figure 1, a protuberance B' will appear on the strip of dough B. This results in turbulent flow in the dough, whereby the dough will be subjected to undesirably great stress. Furthermore, the strip of dough may be spread in the widthwise direction while passing along the upper flight 9 of the entrance belt conveyor 18. As a result, a dough sheet of a good quality and a uniform width will not be produced.

In circumstances where it is not required to produce stretch dough sheets of different thicknesses, and if the thickness of the strip of dough to be fed into the apparatus is varied, the above-mentioned problems inherent in the known apparatus of Figure 1 can be overcome simply by constructing the entrance belt conveyor 18 so that its upper flight 9 is positionally adjustable. Although such an embodiment is not illustrated, it will readily be understood that the upper flight 9 of the entrance belt conveyor 18 of Figure 1 can be arranged to be pivotally adjustable by means similar to that shown in Figures 4 and 5, so that the spacing  $T_a$  can then be controlled to match the thickness of the strip of dough to be fed into the apparatus, thereby attaining the desired rolling distance  $l$ . Thus a constant relationship can be maintained between the width  $W_1$  of the strip of dough fed into the apparatus and that  $W_2$  of the dough sheet produced by the apparatus.

It will also readily be understood that the upper flight 9 of the entrance belt conveyor 18 may be positioned parallel to the lower straight

portion S of the roller mechanism R, in place of the arrangement shown in Figure 1, and that the upper flight 9 can then be modified, without any difficulty, to be vertically movable similarly to the upper flight 10 of the exit belt conveyor 120 in the embodiment of Figure 5.

The operation of an apparatus according to the present invention will now be further explained with reference to Figures 4 and 6.

10 First, the thickness  $T_2$  of the dough sheet to be produced is determined, and the spacing  $T_c$  is set, taking the resilience or restoring property of the dough into consideration, by rotating the motors 27 to vertically adjust the roller mechanism R. Here it should be noted that when the dough resilience is substantially zero,  $T_2$  is practically equal to  $T_c$ , whilst that when the dough is very resilient,  $T_2$  is slightly greater than  $T_c$ . Therefore, when the product requires high precision in its thickness,  $T_2$  should be carefully set after precisely measuring the resilience of the dough.

20 Next, the speed  $V_2$  and width  $W_2$  of the dough sheet to be carried away by the exit belt conveyor 20 are determined.  $V_2$  is substantially equal to the speed of the exit conveyor belt, when the dough resilience is substantially zero. When the dough is more resilient, however,  $V_2$  is slightly less than the speed of the exit conveyor belt.

30 The values  $T_2$ ,  $V_2$ , and  $W_2$  are now fed to an input unit 33, as input data. Then, the sensor 23 measures the thickness  $T_1$  and width  $W_1$  of the strip of dough conveyed by the entrance belt conveyor 18 and transmits such information to the motor 16. The motor 16 rotates in response to the feeding of the information of the thickness  $T_1$ , thereby causing the plate 15 to move vertically until the spacing  $T_a$  becomes equal to the dough thickness  $T_1$ .

The above data  $T_1$ ,  $T_2$ ,  $V_2$ ,  $W_1$  and  $W_2$  are fed to a computer 34. When the dough resilience is substantially zero,  $V_1 \times T_1 \times W_1$  is substantially equal to  $V_2 \times T_2 \times W_2$ . Therefore,  $V_2$  is automatically  
5 calculated by the computer 34 from the equation.

A signal indicative of  $V_1$  is transmitted from the computer 34 to the variable speed motor 17, thereby determining the speed of the entrance belt conveyor 18.

10 The operation of the apparatus shown in Figure 5 is similar to that of Figure 4, except that the thickness  $T_2$  is determined by rotating the motor 131 to vertically adjust the conveyor plate 128, while the thickness  $T_2$  in the apparatus in Figure  
15 4 is adjusted by the vertical movement of the roller mechanism R.

It will be readily understood that an apparatus according to the invention in which the upper flight of the entrance belt conveyor is the only member  
20 arranged to be adjustable, can also be operated similarly to the above.

In cases where the dough resilience is substantially zero, assuming  $W_1 = W_2$ , the relation  $V_1 \times T_1 = V_2 \times T_2$  holds. It can be seen in this case that the  
25 dough flows regularly through the apparatus while maintaining a uniform width, and therefore dough can be stretched without generating any substantial turbulence therein.

Further, when it is desired to increase the  
30 width  $W_2$  relative to  $W_1$ , assuming both  $T_1$  and  $T_2$  are unchanged, a larger value should be selected for  $V_1$  to satisfy the relation  $V_1 \times T_1 > V_2 \times T_2$ , since  $W_2 > W_1$  in the equation  $V_1 \times T_1 \times W_1 = V_2 \times T_2 \times W_2$ . The above relation can be inversed  
35 to provide the relation  $W_2 < W_1$ . Thus a dough sheet produced can have a predetermined width.

In cases where the dough is resilient, a dough sheet having a desired thickness and/or width



can be produced by including a resiliency coefficient peculiar to the dough in question, in the above equation.

It will be understood from the foregoing description that in use of apparatus according to the present invention, the spacing between the upper flight of the entrance belt conveyor and the lower straight portion of the roller mechanism can be changed to conform to the thickness of the strip of dough to be fed into the apparatus, whereby to stabilize the dough stretching effect.

Also, in use of apparatus according to the invention, the ratio between the spacing  $T_c$  between the upper flight of the exit belt conveyor and the lower straight portion  $S$  of the roller mechanism and the spacing  $T_a$  between the upper flight of the entrance belt conveyor and the lower straight portion  $S$  of the roller mechanism is measured, the spacing  $T_c$  being adjusted if necessary to take the dough resilience into consideration, and depending on the value of this ratio, the ratio of the speed  $V_2$  of the exit belt conveyor to the speed  $V_1$  of the entrance belt conveyor is automatically set to satisfy the relation  $V_1 \times T_1 = V_2 \times T_2$ ,  $V_1 \times T_1 > V_2 \times T_2$ , or  $V_1 \times T_1 < V_2 \times T_2$ , thereby substantially eliminating the instability of the dough stretching effect which is inherent in the prior art apparatus, increasing the flexibility of the apparatus to accommodate itself to wide ranges of thickness and width of a dough sheet to be stretched, and generally facilitating operation of the apparatus.

Claims

1. Apparatus for continuously stretching a strip of dough, comprising:

- 5 a belt conveyor mechanism comprising a series of at least two belt conveyors the upper flights of which are adapted to underlie and support the strip of dough to carry it along a predetermined path, said series of belt conveyors including an  
10 entrance belt conveyor for feeding the strip of dough into the apparatus, and an exit belt conveyor for discharging the stretched sheet of dough from the apparatus, the exit belt conveyor being movable faster than the entrance belt conveyor; and  
15 a roller mechanism comprising a plurality of freely rotatable rollers movable in unison along an endless roller path, the peripheries of the moving rollers forming a closed envelope having a lower straight portion spaced from and above  
20 the upper flights of said series of belt conveyors so that the rollers contact the strip of dough during their movement along said lower straight portion, the rollers being arranged to move in the same direction as the strip of dough when passing  
25 along said lower straight portion but at a speed greater than that of the said strip;

the upper flight of the said exit belt conveyor being located substantially parallel to said lower straight portion to define a predetermined vertical  
30 spacing therebetween; and

the upper flight of the entrance belt conveyor being located either parallel to, or in a tapering relationship with, said lower straight portion to define a predetermined vertical spacing between  
35 the starting point of said lower straight portion, or points adjacent thereto on the said envelope, and the upper flight of the entrance belt conveyor; characterized in that

of the roller mechanism (R) and the said upper flights (9,10) of the entrance and exit belt conveyors (18,20), at least two of the such three parts are arranged to be positionally adjustable in the vertical direction so as to provide a desired vertical spacing ( $T_a$ ) between the starting point of the said lower straight portion (5), or points adjacent thereto on the said envelope, and the upper flight of the entrance belt conveyor, and/or a desired vertical spacing ( $T_c$ ) between the upper flight of the exit belt conveyor and the said lower straight portion, depending on the thickness ( $T_1$ ) of the strip of dough to be fed into the apparatus and the desired thickness ( $T_2$ ) of the sheet of dough to be discharged out of apparatus.

2. Apparatus according to claim 1, wherein the said upper flight (9) of the entrance belt conveyor (18) is arranged to either pivot up and down or to move vertically.

3. Apparatus according to claim 1 to 2, wherein the said upper flight (1) of the exit belt conveyor (20) is arranged to move vertically.

4. Apparatus according to any of claims 1 to 3, wherein the said roller mechanism (R) is arranged to move vertically.

5. Apparatus for continuously stretching a strip of dough comprising:

a belt conveyor mechanism comprising a series of at least two belt conveyors the upper flights of which are adapted to underlie and support the strip of dough to carry it along a predetermined path, said series of belt conveyors including an entrance belt conveyor for feeding the strip of dough into the apparatus, and an exit belt conveyor

for discharging the stretched sheet of dough from the apparatus, the exit belt conveyor being movable faster than the entrance belt conveyor; and

a roller mechanism comprising a plurality  
5 of freely rotatable rollers movable in unison along an endless roller path, the peripheries of the moving rollers forming a closed envelope having a lower straight portion spaced from and above the upper flights of said series of belt conveyors  
10 so that the rollers contact the strip of dough during their movement along said lower straight portion, the rollers being arranged to move in the same direction as the strip of dough when passing along said lower straight portion but at a speed  
15 greater than that of the said strip;

the upper flight of the said exit belt conveyor being located substantially parallel to said lower straight portion to define a predetermined vertical spacing therebetween; and

20 the upper flight of the entrance belt conveyor being located either parallel to, or in a tapering relationship with, said lower straight portion to define a predetermined vertical spacing between the starting point of said lower straight portion,  
25 or points adjacent thereto on the said envelope, and the upper flight of the entrance belt conveyor;

characterized in that

the said upper flight (9) of the entrance belt conveyor (18) is positionally adjustable so  
30 as to provide a desired vertical spacing ( $T_a$ ) between the starting point of said lower straight portion, or points adjacent thereto on the said envelope, and the upper flight (9) of said entrance belt conveyor (18), depending on the thickness ( $T_1$ )  
35 of the strip of dough to be fed into the apparatus.

6. Apparatus according to claim 5, wherein the said upper flight (9) of the entrance belt conveyor

(18) is arranged to either pivot up and down or to move vertically.

7. Apparatus according to any of the preceding  
5 claims, wherein the ratio of the speed of the entrance  
belt conveyor (18) to that of the exit belt conveyor  
(20) is variable depending on the vertical spacing  
(Ta) between the starting point of the said lower  
10 straight portion, or points adjacent thereto on  
the said envelope, and the upper flight (9) of the  
entrance belt conveyor (18), and/or the vertical  
spacing (Tc) between the upper flight (10) of the  
exit belt conveyor (20) and the said lower straight  
portion (S).

15

8. A method for continuously stretching dough,  
comprising:

- (a) feeding a strip of dough onto the upper flight  
of an entrance belt conveyor constituting  
20 the first in a series of at least two belt  
conveyors;
- (b) applying pulling forces to the strip of dough  
by moving each of said series of belt conveyors  
at a speed greater than the adjacent upstream  
25 belt conveyor, while the strip of dough is  
repeatedly contacted by a plurality of freely  
rotatable rollers moving along a lower straight  
portion of an endless roller path, which  
extends above said series of belt conveyors,  
30 and along which the rollers are moved in  
unison in the same direction as the strip  
of dough but at a speed greater than those  
of the belt conveyors; and
- (c) discharging the stretched dough by means  
35 of an exit belt conveyor constituting the  
last in said series of belt conveyors, the  
upper flight of the exit belt conveyor being  
located substantially parallel to the said

lower straight portion of a closed envelope which is formed by the peripheries of the rollers moving along the said endless roller path;

5 characterised by:

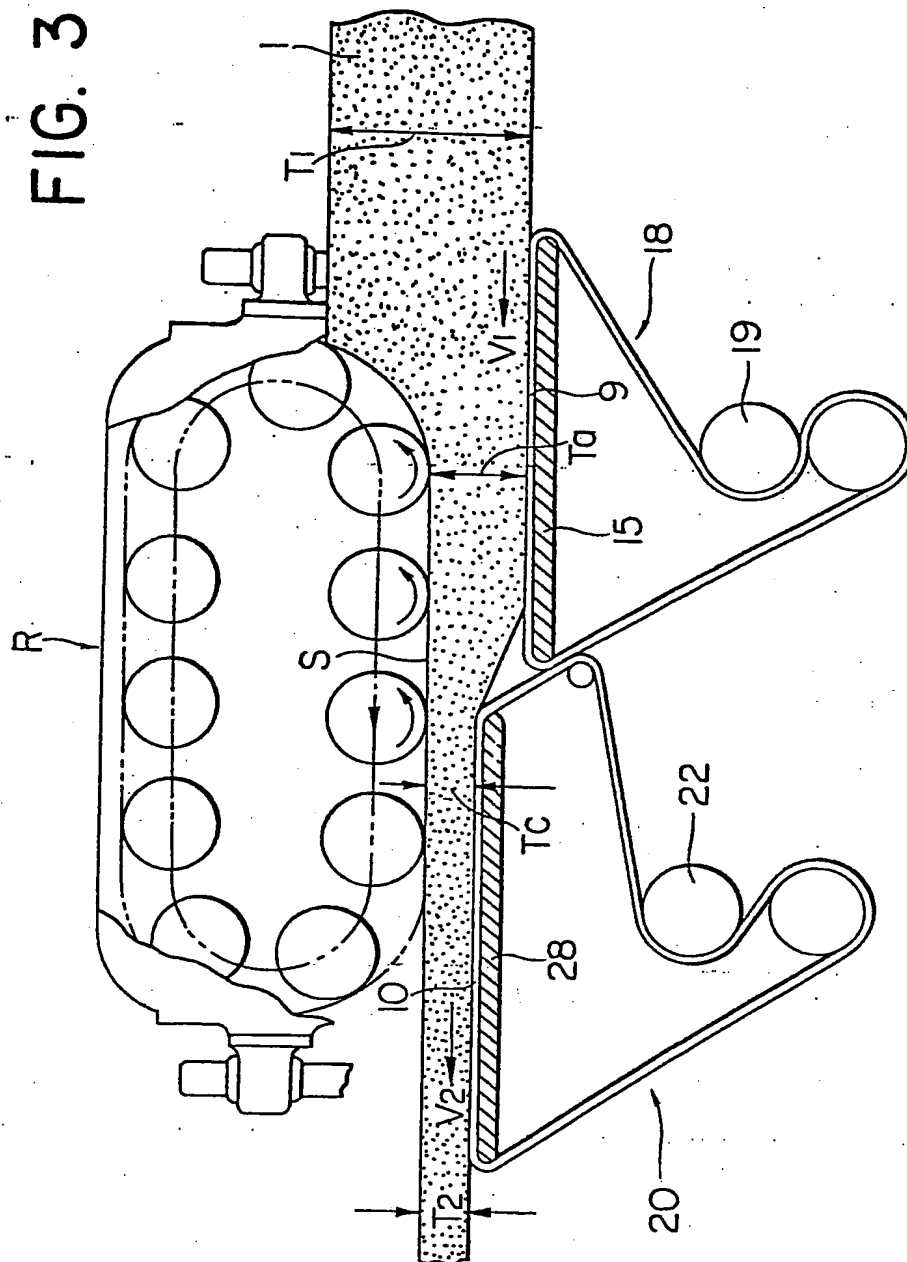
- (d) setting a vertical spacing ( $T_c$ ) between the said upper flight (10) of the exit belt conveyor (20) and said lower straight portion (S) of the endless roller path so as to obtain  
10 the desired thickness ( $T_2$ ) of the stretched dough strip to be discharged, taking the restoring force of the dough into consideration;
- (e) setting the speed ( $V_2$ ) of the exit belt conveyor (20) at a desired value;
- 15 (f) measuring the thickness ( $T_1$ ) of the strip of dough to be fed into the system;
- (g) adjusting the vertical spacing between the said upper flight (9) of the entrance belt conveyor (18) and the starting point of the  
20 said lower straight portion (S), or points adjacent thereto on the said envelope, so as to conform to the thickness ( $T_1$ ) of the strip of dough to be fed in; and
- (h) controlling the speed ( $V_1$ ) of the entrance  
25 belt conveyor (18) in proportion to the ratio of the desired thickness ( $T_2$ ) of the sheet of dough to be discharged to the thickness ( $T_1$ ) of the strip of dough to be fed in.







FIG. 3



4  
G.  
E

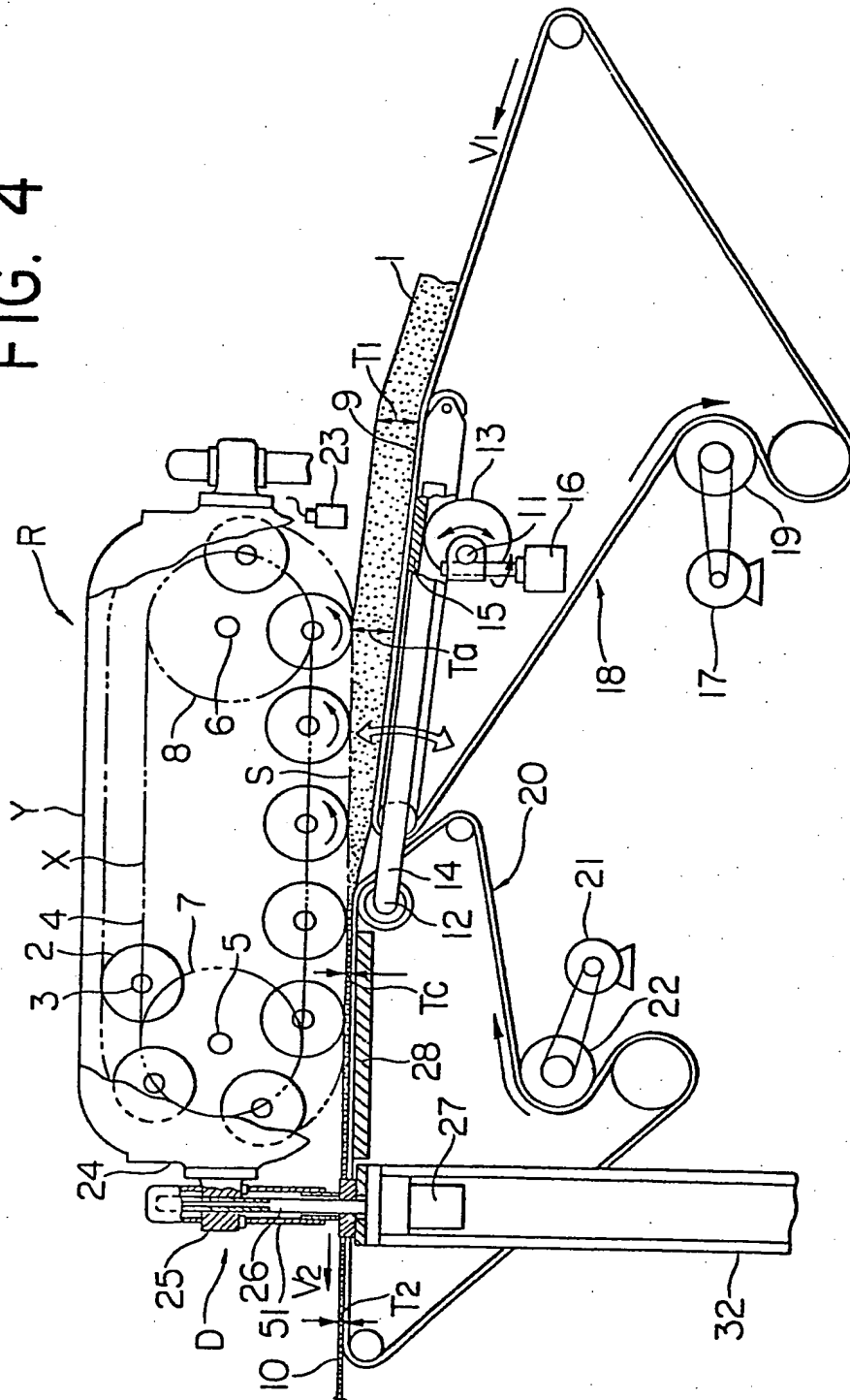


FIG. 5

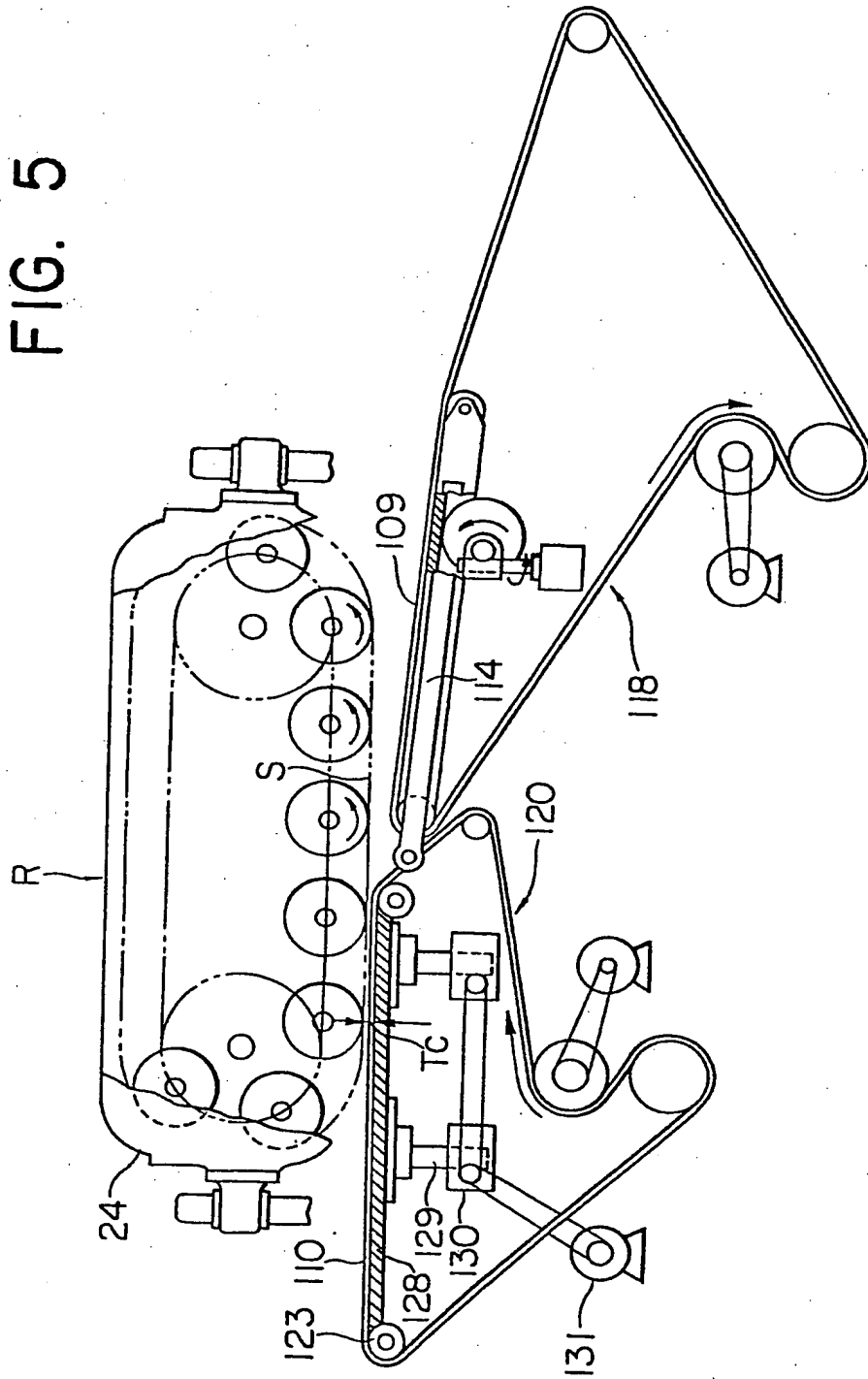


FIG. 6

